A POPULATION ESTIMATE FOR THE MELVILLE PENINSULA CARIBOU HERD IN 1976

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ABSTRACT

The calving grounds of the Melville Peninsula caribou herd were located and surveyed on 19 - 21 June, 1976, using 20% coverage aerial transects. We counted 4,268 adult animals and 702 calves. The population was estimated at 41,400 animals ± 17.3% with 95% confidence. If a correction were made for observation bias the population estimate was 52,000. Productivity was estimated at 62 calves : 100 cows. Comparisons with other surveys suggest that the majority of caribou were missed during previous counts. The present population on Melville Peninsula appears capable of sustaining at least current levels of hunting.

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1. INTRODUCTION

Melville Peninsula, the extreme northeastern tip of mainland Northwest Territories, is one of the least explored regions of Canada. The wildlife resources of the area, including caribou (Rangifer tarandus groenlandicus), are poorly documented.

Rae (1850) recorded seasonal movements of caribou to Melville Peninsula from the Rae Isthmus. Other explorers, including Lyon (1824), Parry (1824), Hall (1879), and Degerbøl and Freuchen (1935), observed caribou on the Peninsula at various times of the year. By 1940 the herd on Melville had apparently declined. Manning (1943) wrote of the migration to Melville: "This migration has now ceased completely, at least as far as the eastern side of the isthmus is concerned. There are still caribou on Melville Peninsula, but they are scarce and consist of small herds moving erratically." He also noted that caribou were so scarce that Eskimos from Igloolik could not obtain enough skins for proper clothing. None of these early observers made systematic studies of the caribou or had the benefit of aircraft for making population estimates.

The Northwest Territories Game Department began surveys of the Melville Peninsula herd in 1971, when Frank Bailey made a survey flight to the northeast of Repulse Bay. Calving ground surveys to estimate the Melville caribou population were carried out by Rippin and Bowden (1972), Pendergast and Bowden (1973), and Bowden and Helmer (1974).

Caribou on Melville Peninsula are hunted by residents of Repulse Bay, Igloolik, and Hall Beach, and furnish an important food source for these communities. One of the proposed Polar Gas Pipeline routes crosses the Rae Isthmus. This route would have to be crossed by caribou migrating to and from calving and summering areas on Melville Peninsula. Since earlier surveys had been hampered by bad weather and navigation difficulties, additional information was required on the numbers and distribution of this herd. In June 1976, an aerial survey of the Melville caribou herd on its calving ground was carried out to determine the size and productivity of the herd.

2. METHODS

Our survey covered the southern half of Melville Peninsula as shown in Figure 1. On 19 June 1976, we flew survey flights to determine the boundaries of caribou distribution. A series of 33 north-south transect lines was established over the area of caribou distribution (Fig. 1). These lines were flown at an elevation of 120 m agl. (above ground level) at 190 km/hr in a Cessna 337 aircraft. Observers in the rear seats scanned a strip 0.4 km wide on each side of the aircraft. The lines were spaced at 4 km intervals over most of the area, and at 8 or 16 km intervals on the periphery. This resulted in 20%, 10% and 5% coverage respectively.

Caribou were counted or estimated by the observers and then classified as bulls (by presence of antlers), unknowns, or cows with calves (all adult animals in groups containing calves were classified as cows). Information was recorded on tape so that the observers did not have to look away from the transect strip. The navigator in the front seat ensured that the aircraft remained on transect and plotted each sighting on 1:250,000 scale maps.

The entire survey required 27 hours of flying in 3 days from 19 June - 21 June. Although the observers experienced some fatigue, there was less chance of caribou moving or of bad weather interrupting a survey carried out in such a short period.

3. RESULTS

3.1 Distribution

Our survey revealed that caribou were distributed across the breadth of Melville Peninsula south of 67°45' N in June 1976 (Fig. 2). Although 2 - 3 weeks had passed since calving, bulls, yearlings and non-productive cows were still sharply separated from cows and calves. Bulls and young animals were distributed south of the calving grounds, concentrated particularly on open slopes around Lyon Inlet and northeast of Mierching Lake.

As we flew south along a transect, we would first see cows and calves almost exclusively. After a point when bulls were seen, cows with calves were rarely or never observed. By connecting points on successive transects where cow-calf sightings ceased, the southern boundary of the calving area was established. The northern boundary was established by flying each transect several kilometers past the last recorded caribou.

Within the calving area of approximately 11,100 km^2, caribou were fairly evenly distributed with an average density of 2.0/km^2 (excluding bulls and calves). Density was calculated, using data from Table 1, by dividing the total numbers of cows and unidentified animals observed (3,588) by the total of all transect areas surveyed (1,782.64 km^2). Group size was small, averaging 4.67 (3,740/803) adults. The largest group we saw was estimated at only 85. There was no evidence by this date in June of the caribou beginning to form the large post-calving herds common to other barren-ground caribou herds (Calef and Lortie 1972, Parker 1972).

3.2 Population Estimate

We observed 3,588 caribou (excluding bulls and calves) on the calving grounds (Table 1). Of these, 2,260 were cows with calves, or adult animals in groups where calves were present, and 1,328 were not accompanied by calves. The addition of bulls, and animals south of calving areas, brings the total adults observed in the survey to 4,268.

By multiplying the area of the calving grounds (11,126 km^2) by the estimated density of cows and unidentified animals (2.0 caribou/km^2; from Table 1), the number of caribou on the calving grounds was calculated at 22,253.

To calculate the total number of caribou in the population, it is necessary to know the age structure and sex ratio of the animals on the calving grounds, so that the estimate of numbers can be corrected for missing age and sex classes. Unfortunately, we did not have a helicopter to do segregation counts of caribou on the calving grounds. Therefore, for our calculations we assumed that sex and age ratios on the Melville Peninsula calving grounds would be similar to those of other herds, particularly the other herds of eastern Keewatin. Parker (1972) and Heard (1980) found that 80% of caribou one year of age and older on the calving grounds of these herds were adult breeding females. Applying this figure to our estimate of the Melville herd results in an estimate of 17,802 (22,253 x 0.8) breeding cows on the calving grounds. According to Parker (1972), breeding females comprise 43% of the total spring population. If a similar proportion of breeding females occurs in the Melville herd, then the total population would be calculated at 41,400 (17,802/0.43). If we assume that we failed to observe 20% of the animals in the survey area (Parker 1972, Thomas 1969), then the final estimate is 51,750 caribou (41,400 x 1.25).

If we wish to place a confidence interval on this estimate, we can estimate density of caribou on each of the 33 transects (Table 1) and calculate the standard error of these estimates. Since the transects are of different lengths, the density estimates are weighted according to transect length. Two different approaches have been used for calculating standard errors from surveys involving transects of unequal lengths:

$$(1)\quad \text{S.E.}\ (\hat{Y}) = \sqrt{(1 - f)}\ x \sqrt{\frac{\xi(y_i^2/L_i) - (\xi y_i)^2/ L_i}{(N - 1)\ \xi L_i}}$$

where y_i = number of caribou observed on transect i

L_i = area covered by transect i

N = number of transects

f = sampling frequency

and (2) $$\text{S.E.}(\hat{Y}) = \sqrt{\frac{1-f}{(n)(\bar{x})}} \times \sqrt{\frac{\sum y_i - 2\hat{R}\sum(y_i x_i) + \hat{R}^2 (\sum x_i)^2}{n-1}}$$

where f = sampling frequency

n = number of transects

$\bar{x}$ = mean transect area

y_i = number of caribou observed on transect i

x_i = area of transect

$$\hat{R} = \frac{\sum y_i}{\sum \overline{x_i}}$$

Equation (1) assumes that variance is inversely proportional to transect length (M. Kingsley, C.W.S., Edmonton, pers. comm.). Equation (2) (Cochrane 1977) assumes that variance is constant for all transects. The 95% confidence interval for our population estimate applying Equation (1) is ±17.3% (0.176 x 1.96/2.0). The 95% confidence interval applying Equation (2) is ±15.8% (0.161 x 1.96/2.0).

The precision of the 1976 Melville Peninsula caribou survey was much greater than that of previous calving ground surveys in the Keewatin (Cook and Jacobson 1976). This is primarily because of the high variation in density between sampling blocks used in previous surveys. The high variation in density from area to area on the Kaminuriak calving ground, for example, is probably a result of the formation of large post-calving aggregations. Density was less variable between transects on the Melville calving area.

Another potential, unmeasurable source of error in the past surveys on the Kaminuriak calving grounds was the presence of many groups too large to count accurately. For example, in the 1971 Kaminuriak survey, only 11% of the total survey count was based on exact counts; the remaining 89% was estimated (Cook and Jacobson 1976). This did not seem as great a problem in our survey on Melville Peninsula where 70% (2,978/4,268) of the total number of animals observed on the survey was based on exact counts, rather than estimates. Even when we had to estimate, the groups were usually small (i.e. 20 - 75) and therefore were probably estimated more accurately than groups numbering in the hundreds.

Our estimate of 41,400 caribou represents a minimum estimate for Melville Peninsula. We did not fly the northern half of the Peninsula. On several transects, heavy trails were seen heading north and northwest, indicating that many animals may have left the area. We would have expected some dispersal of caribou away from the calving grounds by the time of the survey, which took place 2 - 3 weeks after calving.

3.3 Productivity Estimate

Our estimate of calf production in the Melville herd is subject to some doubt. During the survey we made accurate counts of calves only in small groups of caribou close to the aircraft. In larger groups, or those further from the aircraft, we could estimate only a percentage of calves. For groups in which calves could be accurately counted, the ratio was 62 calves: 100 cows (702/1,133). This figure represents productivity within the range of initial calf crops observed in other studies. However, the actual production by the Melville Peninsula herd may well have been higher. The larger cow-calf groups on the calving grounds may have included even higher percentages of calves, since cows with calves generally band together in "nursery groups" (Pruitt 1960). These larger groups had to be omitted from estimates because we could not count them accurately while we were on transect. To obtain the true calf crop, a separate, careful, ground segregation of random groups on the calving grounds should be carried out.

4. DISCUSSION

The discovery of a major caribou herd on Melville Peninsula was unexpected. Previous surveys had located only a few hundred caribou and resulted in rough population estimates of 2,200 (Rippin and Bowden 1972), 3,100 (Pendergast and Bowden 1973) and 1,328 (Bowden and Helmer 1974).

It is difficult to reconcile the previous population estimates with the 1976 estimate. Either previous surveys missed the majority of the animals, or else there has been a migration of caribou to the Peninsula in the past two years. The former seems most likely. Previous surveys were hampered by poor visibility, high winds, and navigation difficulties. Also, these surveys covered only a small part of the area in which caribou were found in 1976. A major population shift to Melville Peninsula is possible but seems to us unlikely, as substantial caribou populations still occur on the mainland to the west of Melville Peninsula (Heard et al. 1980).

The population estimate of 40,000 - 50,000 for the Melville Peninsula herd makes it one of the largest in North America with only six or seven herds currently larger (Calef 1974). Clearly the herd has grown substantially since the 1940's and 1950's when caribou were scarce (Manning 1943, Banfield 1954). The fears expressed by Rippin and Bowden (1973), about overharvest of the Melville caribou appear groundless. The current kill by the Melville Peninsula communities, which averages only 1% - 2% of the current population (Table 2), is clearly within the sustainable yield.

5. RECOMMENDATIONS

Since the 1976 calving ground survey revealed a major caribou herd on Melville Peninsula where previous surveys had indicated only a small scattered population, this survey should be repeated. The population estimate should be refined in the following ways:

(1) A more detailed preliminary survey should be flown to establish differences in density on the calving grounds (strata), so that transects can be allocated among strata according to density.

(2) An attempt should be made to reduce the proportion of those caribou groups which are estimated rather than counted accurately. This can be done by deviating from transect to count or photograph groups larger than 20 animals.

(3) Segregation samples of the population must be made on the calving ground and during the rut to determine the sex and age structure of the population so that the calving ground census can be extended to the entire herd.

(4) An accurate sample of the cow-calf ratio should be obtained at several times during the year to determine productivity and calf survival for the Melville herd.

In addition to obtaining a refined population estimate, more surveys should be carried out to determine the seasonal distribution of the Melville caribou, particularly their winter ranges and migrations, and their affinities with the caribou of the mainland to the west. Such studies are best carried out using animals marked with radio transmitter collars as an aid to following movements and locating caribou concentrations.

Table 1. Numbers of caribou observed on the Melville Peninsula calving grounds - June 1976.

Transect number	Transect area/(km^2)	Cows[1]	Calves	Unidentified animals	Bulls	Cows and unidentified animals/km^2
1	36.26	130	21	0	0	3.58
2	55.68	95	30	20	0	1.46
3	49.21	50	22	0	0	1.01
4	24.60	57	36	32	1	3.61
5	14.24	0	0	51	26	3.57
6	10.36	2	2	50	18	5.01
7	10.36	10	6	1	1	1.06
8	19.42	42	2	56	14	5.04
9	24.60	70	21	107	1	7.19
10	44.03	62	19	50	2	2.54
11	42.73	13	7	6	0	0.44
12	42.73	2	2	8	8	0.23
13	41.44	28	4	11	1	0.94
14	40.14	105	3	40	2	3.61
15	38.85	46	14	0	2	1.18
16	49.21	16	14	36	2	1.05
17	69.93	75	31	27	1	1.45
18	67.34	79	26	52	5	1.94
19	67.34	41	21	21	6	0.92

(cont'd next page)

Table 1. (cont'd)

Transect number	Transect area/(km^2)	Cows[1]	Calves	Unidentified animals	Bulls	Cows and unidentified animals/km^2
20	56.98	20	16	16	0	0.63
21	82.88	95	45	60	5	1.86
22	88.06	92	61	188	3	3.18
23	91.94	216	49	46	5	2.84
24	93.24	242	35	53	2	3.16
25	88.06	145	31	15	3	1.81
26	85.47	87	34	33	2	1.40
27	64.75	84	42	19	3	1.59
28	56.98	122	23	6	0	2.24
29	67.34	48	29	33	3	1.20
30	80.29	126	31	44	8	2.11
31	70.70	45	16	107	17	1.95
32	55.68	15	9	66	5	1.45
33	51.80	0	0	74	6	1.42
Total	1,782.64	2,260	702	1,328	152	2.04

[1] Cows classified as those animals accompanied by calves or in groups containing calves.

Table 2. Numbers of caribou killed by General Hunting Licence holders from three communities on Melville Peninsula, 1963 to 1975.

Settlement	Year 1963/64	64/65	65/66	66/67	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75
Repulse Bay	232	284	282	254	302	273	281	554	450	549	-	-
Igloolik - Hall Beach	-	-	-	-	20	-	-	586	20	231	766	703
Total	232+	284+	282+	254+	322	273+	281+	1,140	470	780	766+	703+

-: indicates no records available.

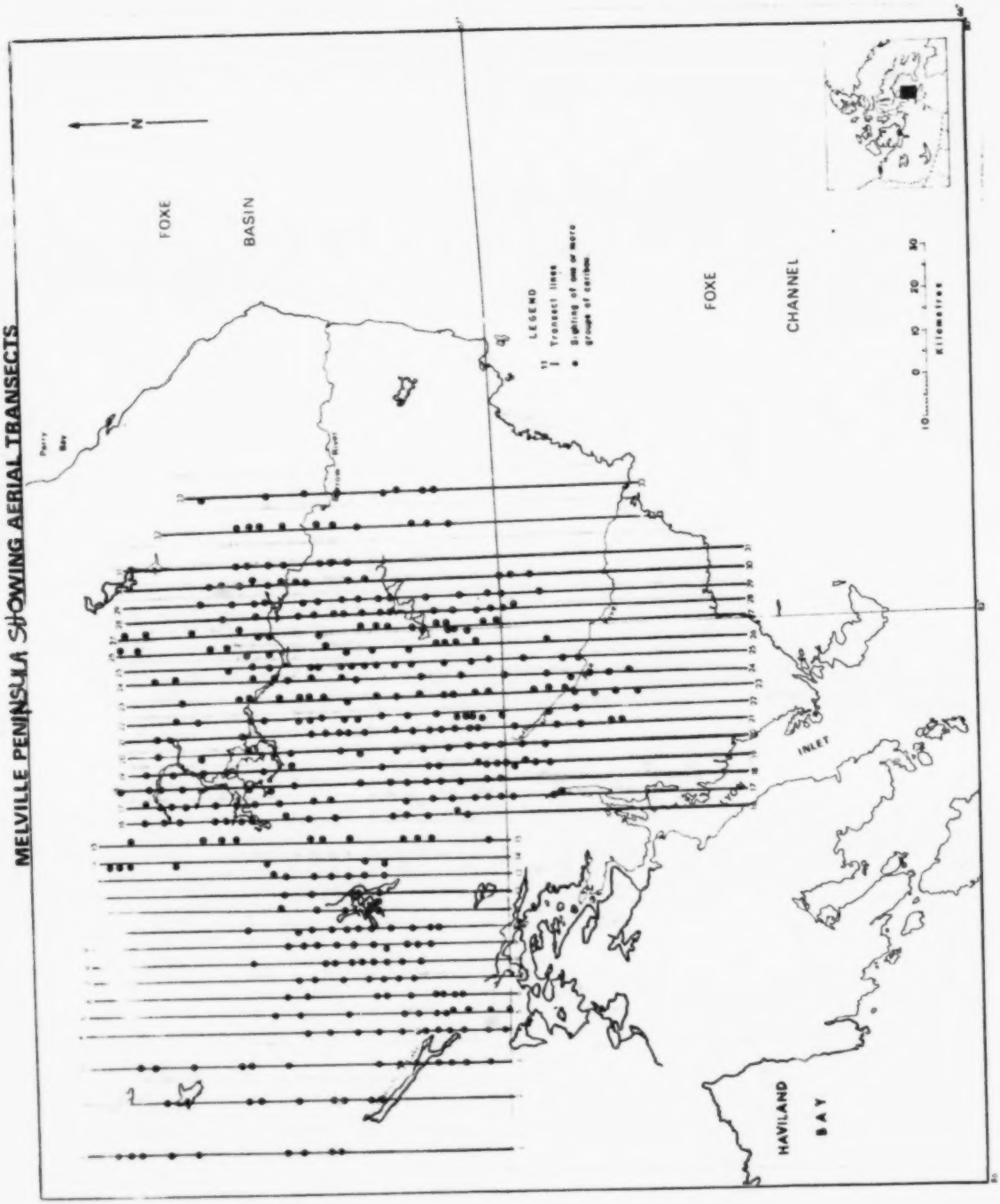

Figure 1. Map of southern Melville Peninsula showing the location of the 33 transects flown over the calving grounds in June 1976.

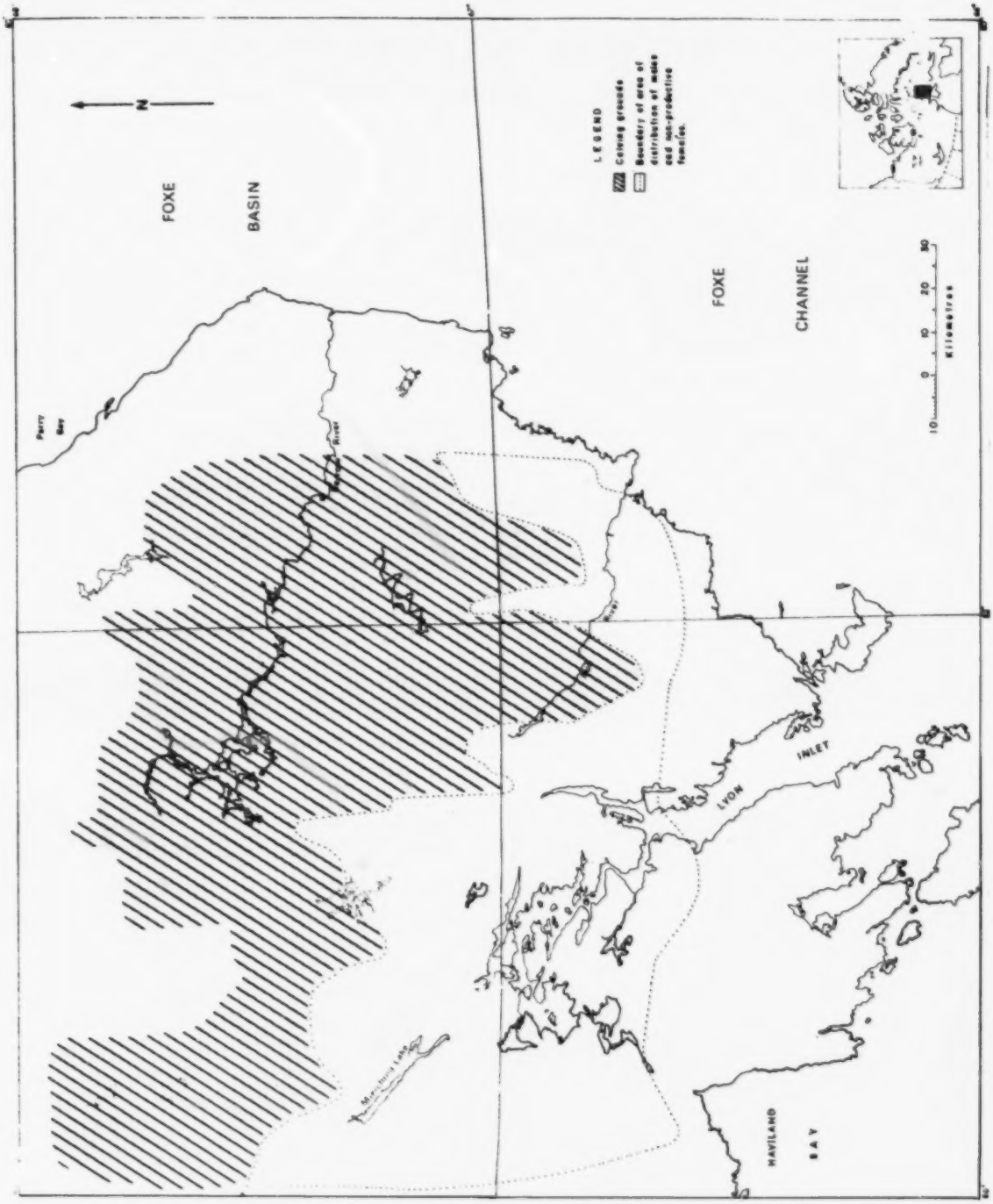

Figure 2. Southern Melville Peninsula showing the location of caribou calving grounds and distribution of bulls and non-productive animals in 1976.

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